

Having described the invention, we claim:

1. An induction heating apparatus for heating workpieces moving through said apparatus, comprising:
  - a housing;
  - a tube in said housing defining a generally enclosed space in said housing through which the workpieces travel as they move through said apparatus, said tube having an inlet end for receiving workpieces and an outlet end for discharging workpieces;
  - an induction coil for heating the workpieces as they move through said enclosed space;
  - an air inlet in said tube for enabling air to flow into said enclosed space;
  - an air outlet in said tube for enabling air to flow out of said enclosed space to the exterior of said housing; and
  - a fan operative to move air through said enclosed space between said air inlet and said air outlet;wherein said air inlet in said tube enables air to flow from the interior of said housing into said enclosed space.
2. An apparatus as set forth in claim 1 wherein said fan is a suction fan connected with said air outlet and operative to draw air through said enclosed space.

3. An apparatus as set forth in claim 2 wherein said housing is pressurized with heated air from power and control circuitry associated with said induction coil.

4. An apparatus as set forth in claim 3 wherein said fan is located in the path of air flow from said air outlet and is operative to draw air out of said air outlet.

5. An apparatus as set forth in claim 1 further including a heater located inside said housing at said air inlet of said tube for heating air flowing into said tube.

6. An apparatus as set forth in claim 1 wherein said housing has opposite end walls for supporting said tube, each one of said end walls having a support member on which a respective end of said tube rests to block downward movement of said tube end, each one of said end walls having a stop member movably connected with said end wall at a location above said tube end to block upward movement of said tube end, said tube being removable from said housing by lifting upward out of said housing.

7. An induction heating apparatus for heating workpieces, comprising:  
a housing;  
a tube in said housing defining a generally enclosed space in said housing through which the workpieces travel as they move through said apparatus;

an induction coil for heating the workpieces as they move through said apparatus;

an air inlet for enabling air to flow into said enclosed space from the interior of said housing;

an air outlet for enabling air to flow out of said enclosed space to the interior of said housing; and

a heater for heating air flowing through said air inlet.

8. An apparatus as set forth in claim 7 wherein said heater is located inside said housing at said air inlet of said tube.

9. An apparatus as set forth in claim 7 wherein said heater is an open coil heater having an air flow passage and a plurality of heating coils extending across said air flow passage.

10. An apparatus as set forth in claim 9 wherein said heater is operative to heat the air flowing through said air inlet to a temperature of at least 50 degrees C.

11. An apparatus as set forth in claim 9 wherein said heater is operative to heat the air flowing through said air inlet to a temperature of about 60 degrees C.

12. An apparatus as set forth in claim 7 further including a first fan for pushing air into said enclosed space and a second fan for drawing air out of said enclosed space.

13. An apparatus as set forth in claim 7 wherein said housing has opposite end walls for supporting said tube, each one of said end walls having a support member on which a respective end of said tube rests to block downward movement of said tube end, each one of said end walls having a stop member movably connected with said end wall at a location above said tube end to block upward movement of said tube end, said tube being removable from said housing by lifting upward out of said housing.

14. An induction heating apparatus for heating workpieces, comprising:  
a housing through which workpieces move as they are heated;  
a tube supported in said housing, said tube defining a passage through which workpieces move, said tube having around it an induction coil for heating the workpieces as they move through said tube,  
said housing having opposite end walls for supporting said tube, each one of said end walls having a support member on which a respective end of said tube rests to block downward movement of said tube end, each one of said end walls having a stop member movably connected with said end wall at a location above said tube end to block upward movement of said tube ends, said tube being removable from said housing upon movement of said stop members.

15. An induction heating apparatus as set forth in claim 14 wherein said housing has a top which when open enables removal of said tube from the top of said housing.

16. An apparatus as set forth in claim 15 wherein said stop members can be disconnected from said end walls to enable upward movement of said tube relative to said housing for removal of said tube from said housing.

17. An apparatus as set forth in claim 16 wherein said each one of said stop members is a bolt that is threadedly engaged with said end wall.

18. An apparatus as set forth in claim 14 wherein said tube ends have a circular configuration and said support members on said end wall have a semi-circular configuration that is concave upward.

19. An induction heating apparatus for heating workpieces moving through said apparatus, comprising:

a housing;

a tube in said housing defining a generally enclosed space in said housing through which workpieces travel as they move through said apparatus, said tube having an inlet opening for receiving workpieces and an outlet opening for discharging workpieces;

an induction coil for heating the workpieces as they move through said enclosed space;

a first fan operative to push air from the interior of said housing into said enclosed space through said inlet opening of said tube; and

a second fan operative to pull air from said enclosed space through said outlet opening of said tube.

20. An apparatus as set forth in claim 19 wherein said first fan is operative to push air from the interior of said housing into said enclosed space through said inlet opening of said tube.

21. An apparatus as set forth in claim 19 wherein said apparatus includes power and control circuitry associated with said induction coil, said first fan being operative to move air past said power and control circuitry into said housing and thence into said enclosed space through said inlet opening of said tube.

22. An apparatus as set forth in claim 19 wherein said apparatus comprises an inlet hub that supports an inlet end of said tube, said inlet hub having a heated air inlet opening separate from said inlet opening of said tube and through which air flows into said inlet opening of said tube, said apparatus further comprising a heater mounted in the interior of said housing for heating air flowing through said air inlet opening.

23. An apparatus as set forth in claim 22 wherein said apparatus comprises an outlet hub that supports an outlet end of said tube, said outlet hub having a heated air outlet opening separate from said outlet opening of said tube

and through which air is pulled from said enclosed space of said tube by said second fan.

24. An induction heating apparatus for heating workpieces, comprising:  
a cabinet through which workpieces move as they are heated, said cabinet having a plurality of walls including first and second opposite end walls, said walls of said cabinet defining an opening on the top of said cabinet;  
a tube supported on said opposite end walls of said cabinet, said tube defining a passage through which workpieces move, said tube having around it an induction coil for heating the workpieces as they move through said tube, and  
a cover for said cabinet, said cover being hingedly connected to said walls of said cabinet, said cover being movable between a closed position closing said cabinet and an open position in which said top opening of said cabinet is open to enable removal of said tube through said top opening of said cabinet.

25. An apparatus as set forth in claim 22 wherein each one of said end walls has a support member on which a respective end of said tube rests to block downward movement of said tube end, each one of said end walls having a stop member removably connected with said end wall at a location above said tube end to block upward movement of said tube end.

26. An apparatus as set forth in claim 25 wherein each one of said tube ends has a circular configuration and said support members on said end walls each have a semi-circular configuration that is concave upward.

27. An apparatus as set forth in claim 25 wherein said stop members are bolts that are threadedly engaged with said end walls.

28. An induction heating apparatus for heating workpieces, comprising:  
a housing through which workpieces move as they are heated;  
an induction coil in said housing for heating the workpieces as they move through said housing;  
said housing having a workpiece outlet opening through which heated workpieces exit said housing in a generally horizontal direction with bottom portions of the workpieces sliding along a surface on the bottom of said outlet opening; and  
a temperature sensor on the bottom of said workpiece outlet opening.

29. An apparatus as set forth in claim 28 wherein said temperature sensor is a thermocouple.

30. An apparatus as set forth in claim 29 wherein said temperature sensor projects upward resiliently from said surface on the bottom of said outlet opening into the path of movement of the bottom portions of the workpieces.

31. An induction heating apparatus for heating workpieces, comprising:  
a housing through which workpieces move as they are heated;  
an induction coil in said housing for heating the workpieces as they move through said housing;



said housing having a workpiece inlet opening through which workpieces enter said housing in a generally horizontal direction; and

a motion sensor at said workpiece inlet opening for sensing motion of the workpieces entering said housing, said motion sensor being a laser sensor.

32. A method of heating air and moving the heated air through a tube in an induction heating apparatus for heating workpieces that move through the tube, the tube being located in an enclosure with an induction heating coil extending around the tube in the enclosure, said method comprising the steps of:

preheating air by moving it past power and control circuitry at a first location that provides power for the induction coil;

moving the preheated air from the first location to the interior of the enclosure;

moving the air from the enclosure into the interior of the tube;

moving the air through the tube to a tube outlet past workpieces that are in the tube to pick up moisture that is driven off from the workpieces by induction heating;

moving the air out of the tube through the tube outlet; and

exhausting the air from the enclosure.

33. A method as set forth in claim 32 further including the step of heating the preheated air with a heater prior to moving the preheated air from the enclosure into the interior of the tube.

34. A method as set forth in claim 33 wherein said step of heating the preheated air includes heating the preheated air to a temperature of at least 50 degrees C.

35. A method as set forth in claim 34 wherein said step of heating the preheated air includes heating the preheated air to a temperature of at least 60 degrees C.

36. A method as set forth in claim 33 wherein said step of heating the preheated air includes heating the preheated air with a heater that is located within the enclosure at a tube inlet outside of the tube.

37. A method as set forth in claim 33 wherein said step of heating preheated air with a heater includes heating the preheated air with an open coil heater having heating coils extending across an air flow passage of the heater.

38. A method as set forth in claim 32 wherein said step of moving the air through the tube to a tube outlet includes drawing the air through the tube with a suction fan that is connected with the tube outlet.

39. A method as set forth in claim 38 wherein said step of moving the preheated air from the first location to the interior of the enclosure includes pushing air into the enclosure from the first location.

40. A method of heating air and moving the heated air through a tube in an induction heating apparatus for heating workpieces that move through the tube, the tube being located in an enclosure with an induction heating coil extending around the tube in the enclosure, said method comprising the steps of:

heating air at a location spaced apart from the workpieces in the tube; and

moving the heated air into the interior of the tube and through the tube to a tube outlet past workpieces that are in the tube to pick up moisture that is driven off from the workpieces by induction heating;

said step of moving the heated air into and through the tube including drawing the air into the tube by a suction fan that is connected with the tube outlet.

41. A method as set forth in claim 40 wherein said step of drawing the air into the tube includes drawing the air from the enclosure into the tube.

42. A method as set forth in claim 41 wherein said step of moving the heated air into the tube includes pushing air into the enclosure from a location outside the enclosure.

43. A method as set forth in claim 42 wherein said step of pushing air into the enclosure from a location outside the enclosure includes pushing air that is preheated at the location outside the enclosure.

44. A method as set forth in claim 40 wherein said step of heating air includes preheating air by moving it past power and control circuitry at a first location that provides power for an induction coil.

45. A method as set forth in claim 44 wherein said step of heating air further includes heating the preheated air with a heater prior to moving the preheated air from the enclosure into the interior of the tube.

46. A method as set forth in claim 45 wherein said step of heating the air includes heating the air to a temperature of at least 60 degrees C.

47. A method of removing a tube and associated induction heating coil from an induction heating apparatus that is used to heat workpieces that move through the tube, the tube and the coil being supported inside an enclosure with the coil extending around the tube, said method comprising the steps of:

opening a top of the enclosure; and

lifting the tube and the coil out of the enclosure through the open top of the enclosure.

48. A method as set forth in claim 47 further including the step of moving at least one stop member from at least one end of the tube prior to lifting the tube and the coil out of the enclosure through the open top of the enclosure.

49. A method as set forth in claim 48 wherein said step of moving at least one stop member includes unscrewing one and only one bolt at each end of the tube.

50. A method as set forth in claim 47 including the steps of moving a first stop member at a first end of the tube and moving a second stop member at a second end of the tube prior to lifting the tube and the coil out of the enclosure through the open top of the enclosure.

51. A method as set forth in claim 47 wherein said step of opening a top of the enclosure includes opening a hinged top of the enclosure.